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METHOD AND APPARATUS FOR PLATING TUBES

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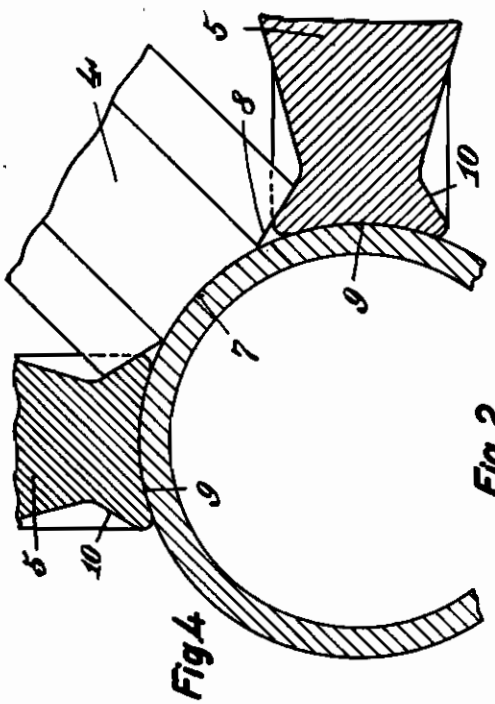

Fig.4

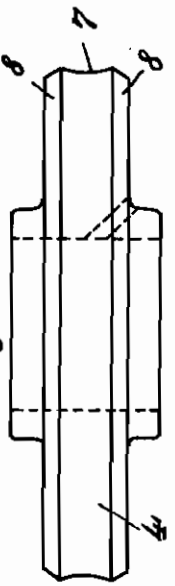

Fig.2

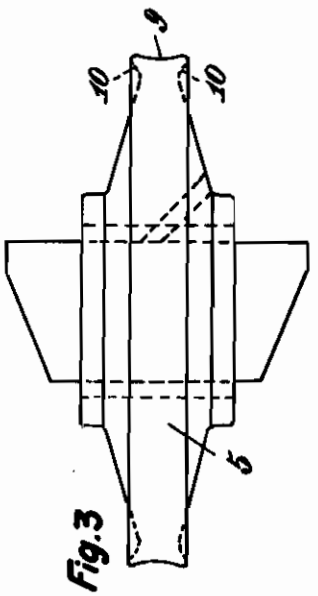

Fig.3

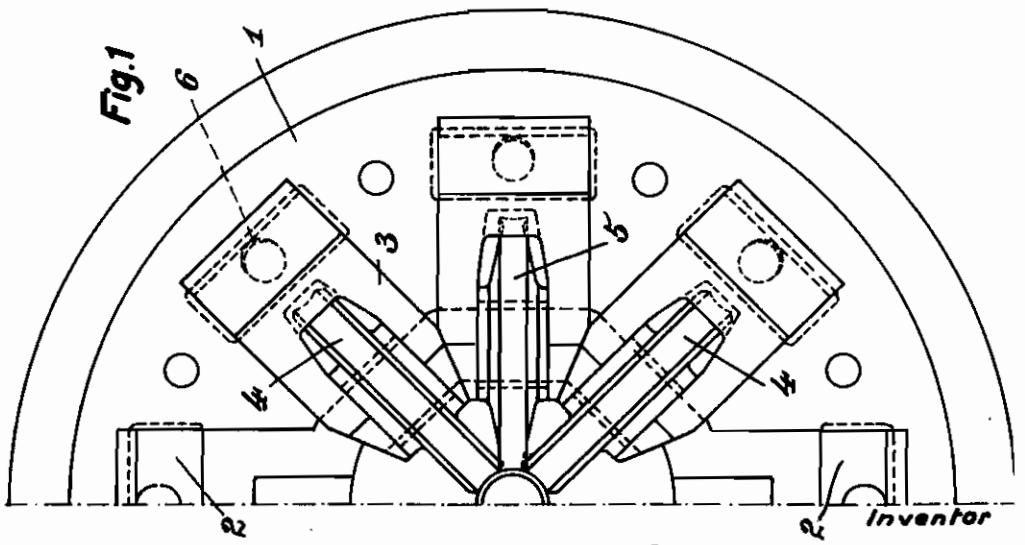

Fig.1

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METHOD AND APPARATUS FOR PLATING TUBES

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This invention relates to methods and apparatus for integrally plating tubes, tubular bodies, wires, rods and the like with another metal, the outer metal of which tubes has a higher coefficient of expansion than the inner metal. According to the present invention, mutual deformation of both of the two layers of metal is avoided so as to prevent collapse or buckling of the inner tube while the pressing of one metal upon the other is performed with sufficient force and at such a temperature that the surfaces to be joined are brought into firm or strong contact and thereby integrally united. In view of the higher coefficient of expansion of the metal of the outer sheath, the two sheaths should fit each other as closely as possible so as to reduce to the minimum the amount of mechanical deformation required to effect pressing of one sheath upon the other in effecting the joining at elevated temperatures.

After the tubes have been telescoped one within the other and heated to welding temperature, the outer tube is drawn to a smaller transverse dimension by means of a drawing-iron or similar implement so as to press firmly with its inner surface on the outer surface of the inner tube and integrally unite said surfaces. It is only necessary to effect a reduction in the cross-section of the outer tube such that intimate contact with the inner tube will be established, and, beyond that, further reduction is undesired as unnecessary deformation and possible collapse are to be avoided.

It is advantageous before heating the materials to the welding temperature to draw the inner and outer tubes over one another, in order to obtain from the start as close a contact of the two tubes as possible and also to expel any air present between the tubes. It is also advisable to flange over the edges of the tube in order to exclude air from the surfaces to be united. For the same reason it is recommended that the material should be heated in a reducing atmosphere.

The drawing implement by which the heated materials are drawn one upon the other and plated is preferably arranged directly in front of the heating furnace, so that the material is conveyed from the furnace directly to this implement. According to the new method the reduction in cross-section only proceeds to such an extent that the materials are pressed firmly together. It has also been found that a greater reduction in cross-section should not be effected since, if this occurs, the tube which has the greater ductility at the temperature in question is pushed off the other tube and plating is not then successfully effected.

It is instructive to note that the drawing-iron which is used for drawing the highly heated tubes is subjected to very heavy wear. Therefore it is advisable to use, instead of a drawing-iron, an iron in which the pass is formed by rotating members.

The production of faultless plating is facilitated if the thin coating of the metal to be plated is deposited on the core metal. This procedure is, however, usually not necessary.

Example

A steel tube of, for example, 30 mm. internal diameter and 36 mm. external diameter is to be coated and plated with a copper tube. For this purpose a copper tube of an internal diameter of approximately 36.5 mm. and an external diameter of approximately 37.3 mm. is preferably employed. In both cases bright drawn tubes are used. Before the plating the copper tube is degreased internally and the steel tube is de-greased externally and the tubes are mechanically cleaned, for example by means of brushes.

After the steel tube has a bright metallic surface on the outside, it is preferably copper coated by an electrolytic method by a short immersion in a copper bath and then rinsed at once in clean water. The dry tubes, after being cleaned in this manner, are then treated by a known process with carbon tetrachloride or a chlorinated hydrocarbon, either by allowing the liquid to evaporate on the clean surfaces or by bringing the surfaces into contact with the carbon tetrachloride or the like in gaseous form. The tubes are then inserted one inside the other and pointed conically so that by using a drawing bar the copper tube can be drawn on to the steel tube. Owing to this cold drawing, the air between the two tubes is expelled. The end of the copper tube which projects to the rear after the drawing is flanged over inwardly in order to prevent the access of air, after which the tubes are introduced into an annealing furnace with the point facing the door of the furnace in which they are heated in a reducing atmosphere to a welding temperature of about 1000° C. The tubes are then drawn through a die disposed in front of the furnace which has a pass of a diameter of about 36.7 mm., so that the reduction in diameter amounts to only a few tenths of a millimeter. After the tubes have been plated in this manner, the cooled tube can be drawn to the finished dimensions in known manner, care being taken that the first

pass is effected very carefully and that an intermediate annealing is undertaken in order to prevent the plated metals from coming apart. After the second intermediate annealing, the plating is so firm that a second drawing can be undertaken without taking any special precautions.

Plating is successfully effected by the new process in spite of the views which have hitherto been held to the effect that it is not possible to unite tubes by drawing and that the plating of tubes can only be performed by rolling the tubes. The new process is considerably simpler and more economical than those hitherto known.

As has already been indicated, instead of a fixed or solid die, a die with rolls, rollers or ball-like profiled parts can be employed in which the friction and therefore the wear is considerably less than when a fixed or solid die is employed.

A drawing implement which is specially adapted for carrying out the new process is illustrated by way of example in the accompanying drawing, in which

Fig. 1 shows the implement in elevation, part of the working rolls being omitted;

Figs. 2 and 3 show respectively on a larger scale the two kinds of rolls which are employed; and

Fig. 4 illustrates on a still larger scale how the rolls cooperate one with the other.

Referring to the drawing, the carrier for the rolls is formed by a base-plate 1 having radially arranged plates 2 to which are fixed the supports 3 in which the rolls 4 and 5 are mounted. Elongated holes 6 in the plates 2 enable the rolls to be accurately adjusted.

The essential feature of the new implement is that two different kinds of rolls, which in combination form a circular pass, are employed. The rolls 4, as shown in Fig. 2, have an arched operative surface 7, the curvature of which corresponds to that of the pass, and conical surfaces 8 adjoin the surface 7 on either side. These surfaces 8 are inclined to one another at an angle of approximately 150°. The rolls 5 also have an arched operative surface 9, the curvature of which corresponds to that of the pass. This working surface 9, however, is slightly greater than the surface 7 of the rolls 4. The working surface 9 of the rolls 5 is undercut, that is to say, the body of the rolls 5 adjacent the surface 9 is narrower than the surface itself and is provided with oblique surfaces 10 against which the conical surface 8 of the rollers 4 bear, as shown in Fig. 4.

During the drawing operation, therefore, the laterally projecting edges of the surfaces 9 are supported by the surfaces 8 of the rolls 4. By this means an approximately closed rigid pass is formed.

Obviously wires, rods and the like as well as in some cases profiled objects can be plated in a similar manner by means of the new process.

When using the new plating process it is generally advisable to work in a protective atmosphere of a reducing or inert gas if the penetration of the oxygen of the air is not effectively prevented by the pressing together of the materials to be plated. The material which has been plated by the new process can be worked up further in known manner by plastic deformation either by hot or cold methods.

This application is a division of our application Serial No. 231,976, filed September 27, 1938, for "Method of plating metals."

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